Dr. Carslaw remarks, the equation of vibration of a stretched string is obtained on the assumption that no such discontinuities occur; if sharp corners exist, dynamical difficulties are introduced.

THE French Physical Society has undertaken the publication of a collection of elementary physical experiments. This book will describe class experiments, and also simple experiments of a suitable character for class exercises. The first part, dealing with geometry, mechanics, gravity, hydrostatics and heat, is now in preparation.

SOME statistics as to the use of alcohol as an illuminant are given by M. L. Denayrouze in the *Bulletin* of the French Physical Society, No. 185. This use of alcohol, first proposed in Germany a few years ago, has recently been rendered practicable from a commercial point of view by the introduction into France of methylated spirits, and also by an increase in the efficiency of the Denayrouze lamp. Taking 1·08 grams of pure alcohol or 0·64 gram of carburetted alcohol (alcohol carburé) per candle hour as the consumption of this lamp, the cost is estimated at 0·00478 and 0·00298 of a penny per candle hour for these two alcohols, as against 0·01428 of a penny for petroleum. The lamp consists essentially of a wick, conducting the liquid by capillarity into a chamber where it is vaporised, the necessary heat being produced by a copper bar which derives its heat from the lamp itself. The vapour passes through a small channel into a kind of Bunsen burner, above which the mantle is fixed. The series of operations is entirely automatic.

THE *Ceylon Independent* of August 11 contains Prof. Herdman's report on the pearl fisheries in the Gulf of Manaar. The objects of the professor's investigations were fourfold. Firstly, to inspect the oyster banks; secondly, to find out the conditions under which the molluscs live; thirdly, to take into consideration the marine zoology of the other Singalese waters in connection with trawling; and, lastly, to select a spot for a marine laboratory. As the result of the survey, it was found that in the main the oysters were healthy and free from epidemic, and, indeed, from much disease of any description. Parasites were present in considerable numbers, but were not considered to be doing much damage. "Spat" were found in abundance in certain localities, and enormous quantities of young oysters in others. A large percentage of these appeared, however, never to reach maturity, either from being destroyed by enemies, choked in sand or overcrowded. The remedy for this is thinning out and transplanting. It is concluded that "there is no reason for despondency in regard to the future of the pearl-oyster fisheries, if they are treated scientifically."

TWO papers of considerable interest on fossil mammals are to hand. In the one—issued by the Cairo Survey Department—Messrs. Andrews and Beadnell describe remains of new forms from the Eocene of Egypt, among which the lower jaw on which the genus Phiomia is based is perhaps the most interesting and remarkable. The other—published in the *Journal* of the College of Science of Tokio—relates to part of a skull from the Tertiary of Japan believed by its describers, Messrs. Yoshiwara and Iwasaki, to indicate a new type of proboscidean.

IN vol. ii. pt. 10 of the *Annals* of the South African Museum, Sir George Hampson continues his valuable catalogue of the moths of South Africa, describing many new genera and species.

THE Museums Association has issued the first volume of its *Journal*, edited by Mr. E. Howarth, and containing an excellent portrait of Sir William Turner. The volume will be welcome to all interested in museum improvement, whether from the general education standpoint or on more strictly scientific grounds.

THREE memoirs of the Geological Survey of England and Wales have recently been issued in explanation of the one-inch maps. That on Ringwood, by Mr. Clement Reid, is accompanied by a colour-printed map which has been admirably executed by the Ordnance Survey. The area described is a part of the Hampshire Basin, and attention is drawn to the evidence of an old river course, which probably in Newer Pliocene times connected the Salisbury rivers with Southampton, before they were captured and diverted along the course of the subsequent Lower Avon. The geology of Southampton, also by Mr. Reid, with contributions by Mr. Whitaker, gives a concise account of the Chalk and Tertiary strata, and of the Pleistocene deposits some of which yield Palæolithic implements. Several new inliers of London Clay have been recognised, and these indicate an extension to the westward of the Portsdown anticline. The geology of the country around Exeter is by Mr. W. A. E. Ussher, and it gives a fairly full account of the Culm-measures, the various divisions of the New Red Sandstone series, and the superficial deposits. Much interest attaches to the volcanic rocks, which are probably of Permian age, and the field-observations are supplemented by petrological notes by Mr. Teall.

A THIRD report on the soils of Dorset, by Mr. D. A. Gilchrist and Mr. C. M. Luxmoore, has been issued by University College, Reading (1902). Attention is directed to the amount of carbonate of lime in the fine earth of various soils, and it is noteworthy that some soils on calcareous formations contain very little carbonate of lime, while the soil on Kimeridge Clay contains in places more than 2 per cent., an amount which decreases in the subsoil. An interim report is given on the general results of the investigations with regard to West Dorset, and many suggestions are made on the capabilities of the land and on the improvements which might be made in the cultivation of it.

THE *Chemical News* for September 5 is a "Students' Number," and contains much useful information respecting the leading schools of chemistry in the country.

THE additions to the Zoological Society's Gardens during the past week include a Campbell's Monkey (*Cercopithecus campbelli*) from the West Coast of Africa; a Bosman's Potto (*Perodicticus potto*) from West Africa, presented by Mr. G. Robertson; a Rhesus Monkey (*Macacus rhesus*) from India, presented by Dr. Bates; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, a Two-spotted Paradoxure (*Nandinia binotata*), a Dorsal Hyrax (*Hyrax dorsalis*) from the Gold Coast, presented by Mr. A. W. Morris; two Suricates (*Suricata tetradactyla*) from South Africa, presented by Capt. C. F. Wanhill, R.A.M.C.; a Suricate (*Suricata tetradactyla*) from South Africa, presented by Colonel J. S. Ewart; two Naked-footed Owlets (*Athene noctua*) European, presented by Mr. A. J. Challis; fourteen Wall Lizards (*Lacerta muralis*) European, presented by Dr. Lewis H. Gough; two Madras Entellus Monkeys (*Semnopithecus priamus*), new to collection, from Southern India; a Pale Genet (*Genetta senegalensis*) from the White Nile; four Blue Lizards (*Gerrhonotus coeruleus*) from Western North America, deposited.

OUR ASTRONOMICAL COLUMN.

OBSERVATIONS OF VARIABLE STARS OF LONG PERIOD.—Writing in the *Observatory* for September, Prof. Pickering gives an abstract of an earlier paper on the really valuable work that might be done by willing observers who only possess small instruments. He states that the number of telescopes of small size (*i.e.* 10 to 30 cm. aperture) now in use, is out of all proportion to the meagre results obtained by their aid, and suggests that observations of long-period variables by Argelander's method would, if systematically made, prove of real value in furthering our knowledge of these objects.

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Prof. Pickering suggests the use of the charts of the Bonn Durchmusterung for this work—and their recent republication renders them accessible to all—but he adds that the star images are too small to use at the telescope; in order to overcome this difficulty, photographic enlargements, on a scale $1' = 0{\cdot}1$ cm., of the regions for 3° around sixty-nine of these variables, have been prepared, and will be forwarded free of cost to experienced observers who are willing to cooperate in this work (*Circular* No. 53, H.C.O.).

To render these observations really valuable, they must be made systematically and each object must be observed once a month, or better still, once a week, by someone amongst the cooperated observers. Then again, the observations must be recorded on a uniform system of magnitudes, and for this purpose it is suggested that the combined observations of the Lick, Yerkes, McCormick and Harvard observatories for the past twenty-five years should be used. When finally reduced and brought together, it is expected that these will embrace all stars, down to the sixteenth or seventeeth magnitude, for the whole of the sky. To facilitate matters further, the whole of the magnitudes on Hagen's charts are being reduced to the photometric scale, so that all that will then be necessary will be to select a star slightly fainter and one slightly brighter than the variable, and record the catalogue numbers, with the date. Further improvement may be made in the observations if the magnitude intervals, and the minute and second of the observation, are also recorded, although the latter are not essential in the cases of long-period variables. Prof. Pickering concludes with the assurance that "if such observations, for which no apparatus but an ordinary telescope is required, are made systematically, results of great value will be obtained."

THE LICK PHOTOGRAPHS.—In *Bulletin* No. 20 of the Lick Observatory, Prof. Pickering announces that, as so many legitimate requests have been made for the Lick photographs of the moon, comets, nebulæ, &c., it will be possible in the future to purchase lantern slides, copies and prints of these objects on application to the director of the Lick Observatory. The prices and details of these objects may be obtained by teachers, lecturers, &c., on application.

THE DARK SPOT ON JUPITER.—In a letter to the *Observatory*, Herr Leo Brenner refutes the idea that the dark spot which Messrs. Phillips and Denning observed in the neighbourhood of the Great Red Spot on June 28, is the same spot that he recorded, and named the "pyramid-spot" during the opposition of 1901. He states that the movement of the pyramid-spot during last year was 48° in 85 days, therefore it is impossible for it to have moved the same distance in eight days this year, as it must have done if it is the same spot that was recorded as being under 19° on June 28.

THE IRON AND STEEL INSTITUTE.

THE autumn meeting of the Iron and Steel Institute was held at Düsseldorf on September 3 and following days, and was attended by an unusually large number of members. Mr. William Whitwell, the president, was in the chair, and he was supported by Sir Lowthian Bell, F.R.S., Sir James Kitson, M.P., Mr. Snelus, F.R.S., Sir J. J. Jenkins, M.P., Mr. J. Walton, M.P., Mr. E. Parkes, M.P., and numerous other prominent members from various parts of the world. Addresses of welcome were delivered by Mr. von Holleuffer, the governor of the Düsseldorf district, on behalf of the Prussian Government, by the Mayor of Düsseldorf on behalf of the city, and by Mr. H. Lueg on behalf of the exhibition authorities and the local reception committee. Nine papers were then dealt with. Mr. W. Brügmann read the first paper, which gave an exhaustive account of the progress in the manufacture of pig iron in Germany since the Institute last met in Düsseldorf in 1880. A similar paper dealing with the progress in the manufacture of steel was read by Mr. R. M. Daelen, and Prof. H. Wedding read a paper on iron and steel at the Düsseldorf exhibition. Prof. Heyn, of Berlin, then read an elaborate paper of great scientific and practical interest on the overheating of mild steel. The principal conclusions drawn from the author's researches were as follows:—

When low-carbon mild steel is annealed at temperatures above 1000° C., there is an increase in the degree of brittleness if the annealing period is sufficiently long. This increase is more considerable, and manifests itself the sooner, the higher the temperature of annealing.

Prolonged annealing, say uninterrupted for fourteen days, at temperatures between 700° and 890°, produces no increase in the brittleness. In such cases where the brittleness of the material in its initial state was not yet at the lowest degree possible, by this treatment the lowest degree of brittleness will be attained. Between 1100° and 900° there exists a temperature limit, above which, if annealing is carried on for a longer period and at an increasing temperature, the degree of brittleness increases. Below this limit, however, this is not the case. Overheating does not only occur at most extreme white heat, but manifests itself at considerably lower temperatures, which must, however, exceed the temperature limit just referred to. By suitable annealing, the brittleness of overheated low-carbon mild steel can be eliminated. If annealing is carried out at above 900° C., a short period of about half-an-hour is sufficient. Longer annealing must be the more carefully avoided, the more the temperature limit between 1100° and 900° is exceeded, otherwise the signs of overheating reappear. Below 800° an annealing of even five hours is not sufficient to eliminate the brittleness in overheated low-carbon mild steel, but by annealing of several days' duration, at temperatures between 700° and 850°, this object can be attained. If low-carbon mild steel, which has been annealed for a longer period at a high enough temperature, so that after undisturbed cooling it would show extreme brittleness, is rolled or forged during cooling to bright red-heat, it will exhibit no brittleness when cold. The fracture of overheated low-carbon mild steel generally shows a coarse grain, although this is not necessarily always the case. The single crystal grains of which the structure of the iron is built up, which can be detected under the microscope by suitable etching, are often of considerable dimensions when in the state of overheating. Nevertheless, this is not to be considered as proof positive that overheating has taken place, since the method of cooling also exercises a great influence on the size of the ferrite grains. Rapid cooling from the temperature causing overheating produces fine ferrite grains, without reducing the brittleness appreciably. Moreover, it is possible, by heating low-carbon mild steel for days together at between 700° and 890° C., to bring the material into such a condition that it will show exceedingly coarse ferrite grains, and yet not exhibit brittleness.

An interesting discussion followed the reading of this paper. Mr. J. E. Stead took exception to some of the conclusions. Prof. Tschernoff, of St. Petersburg, described his early researches on the same subject. Mr. Saniter and Mr. Lange supported Mr. Stead.

The first paper dealt with on September 4 was on the compression of steel during solidification in the ingot mould, by Mr. A. Harmet, of Saint-Etienne. This paper, which covers 64 pages, was read in abstract by the secretary, Mr. Bennett H. Brough. Compression with a static pressure acting on the top of the ingot is the principle involved in the Whitworth process. In the Harmet process the upper portion of the ingot is left exposed, and pressure is applied to the base, causing the steel to rise in the conical mould as though being forced through a draw-plate. The process has been introduced with great success and economy at the Saint-Etienne steelworks. In the discussion, favourable opinions of the invention were expressed by Mr. Beardmore, Mr. Windsor Richards, Mr. Snelus, Prof. Howe, of New York, Mr. Vaughan Hughes, Mr. Saniter and Prof. Tschernoff.

Mr. D. Selby-Bigge next read a paper on the application of electric power in the iron and steel industries, and Mr. F. Kylberg, of Benrath, near Düsseldorf, read a paper describing some developments of the use of electricity in ironworks based on American experience and adapted to European requirements. An interesting discussion followed in which Sir Lowthian Bell, Mr. W. H. Massey and several leading continental electrical engineers took part.

Prof. E. D. Campbell and Mr. M. B. Kennedy, of the University of Michigan, communicated a paper on the probable existence of a new carbide of iron, Fe_2C; and Mr. L. F. Gjers and Mr. J. H. Harrison gave a report of the results obtained in equalising the temperature of hot blast. The proceedings concluded with the usual votes of thanks to the local reception committee and to its hon. secretary, Mr. E. Schrödter, who had planned a most attractive programme of visits and excursions. The works visited included the Krupp establishment at Essen, the Union, Hoerde and Hoesch steelworks at Dortmund, the Phœnix works and the Rheinische Stahlwerke at Ruhrort, the

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